

Classification of interstitial lung disease patterns of HRCT images using DCT features

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Objectives: The classification of HRCT image patches with interstitial lung disease (ILD) abnormalities, as a basic component towards the quantification of the various ILD patterns in the lung.

Materials/Methods: Based on 113 HRCT scans, a dataset with nearly 2500 ILD image patches was created with size equal to 21×21pixels. Six lung patterns were considered: normal, ground glass opacity (GGO), consolidation, reticulation, honeycombing and the combination of reticulation with GGO. Initially each patch is described by a feature vector which is then fed to a machine learning classifier. Feature extraction relies on a filter bank containing the 25 basis functions of the 5x5 Discrete Cosine Transform (DCT). After convolving the image with the filter bank, the 10-quantiles are computed on the filter responses for describing the distribution of local frequencies that characterize image texture. The final feature vector with 307 values is fed to a random forest (RF) with 40 trees for the classification. In addition, the database was tested with a deep convolutional neural network (DCNN).

Results: The DCT/RF methodology achieved an overall accuracy in the order of 90% outperforming state-of-the-art methods tested in the same data, by at least 7%. The sensitivity (%)/specificity (%) were: normal 98.8/97.8; GGO 81.3/98.8; consolidation 92.7/99.5; reticulation 85.6/95.7; honeycombing 86/98.9; and combined reticulation/GGO 88.2/94.8.

Conclusion: The proposed pattern classifications showed very promising results outperforming many state-of-the-art methods.

Clinical Relevance: Radiological classification combined with clinical information can improve the diagnostic accuracy of the clinicians.